

SHERBURNE

NARRATIVE REPORT

JANUARY - DECEMBER 1965

N O T I C E

Due to the short time that this refuge has been staffed, it is not applicable to include N.R. forms in this report.

N A R R A T I V E R E P O R T

for

1965

SHERBURNE NATIONAL WILDLIFE REFUGE

PRINCETON, MINNESOTA

J. C. Carlsen Refuge Manager

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Princeton, Minnesota

INTRODUCTION

During the late 1930's and early 1940's a number of sportsmen and conservationists recognized the value of the St. Francis river valley as a wildlife area. The Minnesota Conservation Department was encouraged to study the locality for a wildlife project. In subsequent years, biological as well as engineering and also realty surveys were made. By the early 1960's it became apparent that the project would be of such magnitude that the funds available to the Minnesota Conservation Department would be insufficient. The Conservation Department then formerly requested the Bureau of Sport Fisheries and Wildlife to investigate the area with the idea of establishing a National Wildlife Refuge.

Among the problems needing to be resolved before the project could become a reality were the necessity of obtaining approval of the County Commissioners, the Minnesota Land Exchange Commission and the Migratory Bird Conservation Commission. In March 1963 the Minnesota Land Exchange Commission gave conditional approval which included the requirement for adequate compensation for land removed from the tax rolls by Federal purchase. The Congress enacted revenue - sharing legislation, Public Law 88-523, signed by President Johnson on August 30, 1964. Based on preliminary estimates, this will return to Sherburne County about \$20,000 per year for use on schools and roads.

The Minnesota Land Exchange Commission met jointly with the Sherburne County Commissioners on January 25, 1965 and the Refuge project received the necessary approval. The final hurdle was the Migratory Bird Conservation Commission which approved the Refuge on May 18, 1965.

It was only through the diligent and devoted efforts of many persons that the Sherburne National Wildlife Refuge became a reality. The people who deserve recognition are too numerous to mention but some really distinguished efforts must be noted here. Assistant Regional Director, Urban C. "Pete" Nelson and Refuge Staff Specialist, Lester H. Dundas devoted time and effort far above the call of duty, often in the face of hostile audiences. Gordon B. Jensen and other appraisers in the Regional Office per-

formed much of the necessary groundwork which included personal contact with angry landowners, adverse weather conditions and a tight schedule to meet.

Outside of the Bureau, many persons expressed their interest in the project to their elected officials. Especially notable were the efforts of Ervin A. Bohm of St. Cloud, Minnesota who rallied support in many ways and has received appropriate recognition through the Minnesota Conservation Federation and also the St. Cloud Community Wildlife Club.

To the many other professional Conservationists and sportsmen who were instrumental in making the Sherburne refuge a reality, a most sincere "Thank you" is tendered.

HISTORICAL BACKGROUND

Sherburne County has long been the scene of activity by Indians as evidenced by aboriginal mounds. When the white man first penetrated the area in the seventeenth century, the natives tribes were Sioux. Later on strife between the Sioux and Chippewa resulted in a westward movement of the Sioux. Winnebago Indians occupied a portion of the area in the 1850's but after 1855 all the Indians were moved to reservations in other parts of the state.

Father Louis Hennepin, a Belgian friar, is generally credited with being the first white man to visit the area in 1680. Father Hennepin, in the company of two French soldiers set out from the present site of Peoria, Illinois to explore the area. They were captured by a party of Sioux Indians and taken to the Mille Lacs Lake region about 35 miles north of Sherburne County.

Later Father Hennepin floated down the Rum River thru eastern Sherburne County, on a trip which resulted in the discovery of St. Anthony falls on the present site of Minneapolis.

There was only fur trading, exploration trips and military expeditions thru the area until the first settlers arrived about 1846. Naturally, the first settlements occurred along the Mississippi and Elk rivers and by the late 1850's this area was well settled. It was not until the 1870's that the more remote northern portions of the county (including the St. Francis River valley) were settled under the Homestead Act.

The county was named for Moses Sherburne, a native of the state of Maine, who became an associate justice of the Supreme Court of

Minnesota Territory from 1853 to 1857. He was one of the two compilers of the Public Statutes of Minnesota, 1849-58. After retirement, he resided in Sherburne county until his death in 1868.

Logging, clearing and farming activities of the settlers turned under a thin layer top soil and exposed a sandy soil. Continuous farming activity and removal of cover resulted in serious wind erosion problems. The combination of drought, depression, depletion of fertility and erosion resulted in the establishment of a Soil Conservation district which has planted millions of trees for windbreaks. This activity has expanded into a big industry of Christmas tree farming.

Although the basic economy is still agricultural, more and more light industry is developing and many citizens commute to jobs in the Metropolitan area. Tourism is also a booming industry in which the Sherburne Refuge should play an important part.

The following information has been extracted from a biological reconnaissance report by J. Donald Smith, originally prepared in 1961 and edited by Edward J. Smith in 1962.

I. LOCATION

The Sherburne National Wildlife Refuge lies in the north central portion of Sherburne County, Minnesota. The nearest towns are as follows:

<u>Town</u>	<u>Population</u>	<u>Distance & Direction</u>
Princeton	3,000	5 miles northeast
St. Cloud	35,000	7 miles west
Elk River	2,500	4 miles southwest
Big Lake	700	4 miles southwest
Zimmerman	169	2 miles east
Twin Cities Metro.	2,000,000	45 miles southeast

The nearest national wildlife refuge is the Rice Lake National Wildlife Refuge lying 85 miles to the northeast. The nearest major state owned refuge is the Carlos Avery Refuge and Public Hunting Ground lying 30 miles east in an adjoining county.

II. DESCRIPTION OF REFUGE

The boundary of the Sherburne Refuge includes approximately 31,751 acres.

The St. Francis River is the largest river although a rather small river probably better classed as a stream which meanders through the low, poorly drained marsh meadow terrain of Sherburne County. The stream flows into the county from the north, entering near the small town of Santiago; then bends eastward flowing through a large sedge-blue joint marsh west of County Road #5; then continuing east for several miles through sandy uplands, abruptly turning south again and flowing into the 500 acre Rice Lake which is a shallow open lake formed by a constriction in the stream channel; then eastward again to intercept the stream flowing out of Elk Lake and thence southward again in a very meandering course to eventually enter the Elk River at a point one mile northeast of the town of Big Lake.

To illustrate the meandering character of the stream between Santiago and County Road #5, the straight line distance along the stream course is only 6 miles; however, one must travel 13 miles via the stream between the two points.

Much of the land in the St. Francis River drainage basin consists of low, poorly drained marsh laced with many old drainage ditches designed to hasten the run-off into the river channel. Small marshes are numerous within the refuge. Many of these probably were maintained by beaver dams; however, beaver have been almost completely eliminated from this area because of their interference with drainage. In fact, the presence or absence of beaver in this drainage basin probably influences the success or failure of much of the farming operation that is carried on in the vicinity. If beaver were allowed to increase here the basin would be a continuous series of wet marshes and small lakes of high value to waterfowl.

The soil in the refuge are of uniformly poor agricultural quality. They are composed of dune sand and are classed as either Zimmerman or Hubbard soil types. Top soil is thin and fertility is low. In the past, cropping of wild hay was extensive in the lowlands but the market for wild hay has dwindled so that very little of this is done anymore. Dairy farming is the principal form of agriculture, but many of the land owners have branched out into turkey production and tree farming.

There is considerable wooded land within the refuge boundary composed primarily of red and burr oak. There are a few isolated stands of white and red pine scattered through the area and in the lowlands ash, poplar, elm, willow and alder predominate. There is a fairly dense remnant stand of tamarack in the marsh south of Rice Lake in Orrock township and along the St. Francis River south of the Zimmerman road.

The wetland habitat is divided into four general types:

1. The sedge-blue joint meadow: This type totals approximately 4,000 acres, most of which lies west of County Road #5 in Santiago Township. It is this area and type which provided most of the wild hay and it is in fact a large, low lying wild hay meadow which is now slowly being invaded by willow brush.

2. Closed marsh: There are about 1,500 acres of this type included in the project. These areas are, for the most part, drained. The drainage has been incomplete and water remains in the basin usually to a depth not exceeding one foot all year long. This has encouraged the growth of cattail and river bulrush which, in most cases, completely closed over the water surface. For the first time in many years heavy stands of wild rice developed in this marsh type. Lake Josephine in Section 3 of Orrock Township is typical.

Lake Josephine is a small meandered lake about 300 acres in total area. There are three drainage ditches running into the lake from the west and north and one large ditch leaving lake and flowing east one mile to empty into the St. Francis River below Rice Lake. The lake level in Josephine is thus lowered in the spring and maintained in this condition the remainder of the year until again swollen by spring run-off. The result is now a shallow marsh completely closed over by banner grass, river bulrush and cattail. Wild rice flourishes here in years of low but stable water levels. If fall rains supply enough water to the basin, hunters can use the area and occasionally high duck kills are made here. Public access has been provided by the state on the north shore.

3. Open Marsh: Approximately 600 acres fall in this general category. Of this, Rice Lake in Blue Hill Township accounts for 486 acres. Rice Lake is in reality a shallow enlargement of the river which fills in the spring to a depth of three feet, with a maximum depth of $4\frac{1}{4}$ feet near the outlet. As spring run-off declines, the water levels quickly fall off to one foot or less over the entire lake. This fluctuation seems to prevent the development of emergents in the main body of the lake and inhibits the growth of submerged aquatics. The bottom is covered by a two-foot thick muck layer, underlain by hard sand and gravel. A thin stand of banner grass and river bulrush borders the open water. A light growth of submerged aquatics, primarily sago pondweed and coontail, are found in the main portion of the lake. There are also a few small beds of white water lily developing on the west side of the lake.

Carp are very abundant and, in combination with low water levels, interfere in the development of aquatics.

Water analyses indicate a total alkalinity of 150 ppm and a sulphate ion concentration of 6 ppm. Water chemistry appears to be favorable

for most aquatics including wild rice, which was formerly very abundant in Rice Lake as well as in other lakes in the St. Francis River Watershed.

4. River channel marshes: There are approximately 1,200 acres of this category. The marshes of this type are narrow and long as they follow the meandering river channel, broadening as the surrounding terrain permits to a maximum width of one mile, but averaging one-half mile. There contain many old ox-bows which retain water throughout the year. The river varies in depth from time to time; however, a few holes six feet deep were found. Vegetation in these marshes varies considerably according to depth. Major species are sedge, cord grass, banner grass, reed-canary grass, burreed, wool grass, cattail, smartweed, soft-stem and hard-stem bulrush. Submergents include sago pondweed, mud-plantain, coontail and elodea.

Willow brush is common in much of this marsh type and the higher edges support ash and elm trees. In some stretches of the river the tree growth definitely impeded travel along the river.

Old beaver dams and lod beaver signs are common along the river marsh but the dams have been opened and are ineffective for the most part. It is evident, however, that past beaver activity was responsible for the formation of much of this marsh type.

III. GENERAL HISTORY OF REFUGE AREA

Even years ago when lakes and marshes were in prime condition all through Minnesota, the St. Francis River basin was known as one of the finest wildlife areas in the State. Elderly local residents say that this condition prevailed in this portion of the State until the late 1930's. Prior to that time Rice Lake, Lake Josephine, Big Mud Lake and the other small lakes nearby supported "tremendous" numbers of muskrats, beaver, mink and ducks. Wild rice was the dominant plant on the lakes and in the river in these days. It is interesting to note that Neil Hotchkiss (then an Assistant Biologist, Division of Food Habits and Research, Bureau of Biological Survey) surveyed the lakes in this basin in 1925 and commented on the abundance of wild rice. He listed Rice Lake, for example, as "A Zizania Aquatica marsh". Hotchkiss also noted that Rice Lake was the Best duck lake in that part of the county.

The old timers, of course, associated the abundance of rice with abundant wildlife. Conditions favoring the growth of rice also favored the wildlife of the marshes. Rice Lake was a heavily used rice harvest area for the Indians and they made their last harvest there in 1936. Until 1961 wild rice had not come back in any of the lakes in the St. Francis basin but that year a steadily declining water

level apparently stimulated rice growth and dense stands developed in the shallow marshes.

Two developments occurred in the St. Francis River that severely damaged the wildlife habitat in the basin. The first change was promotion of rapid drainage through a ditch system completed in the 1920's. While this was not very effective immediately due to beaver activity, it became so when the price for beaver pelts increased to a substantial amount during World War II. Special permit trapping of nuisance beaver has been allowed during the period of the high water beginning in 1941. This almost eradicated beaver from the entire basin.

The resulting improved drainage and the beaver control apparently contributed to higher peak flows in the spring and following heavy rains that occurred before. Drainage also has contributed to the lower water elevations maintained through the remainder of the year. The basin cannot now hold as much water for as long a period as it could under natural conditions. This change has reduced substantially both the quantity and quality of aquatic habitat in the St. Francis River Basin. Wild rice is particularly vulnerable to fluctuating water levels and could not now flourish in the basin except in drought years such as 1961.

The second development was the carp invasion of the lakes and streams in this basin that occurred during the early 1940's following the drought years. There now is a substantial carp population well established in the St. Francis and Elk River basins. In the shallow mud-bottom typical of these waterfowl marshes the carp seem to be particularly effective in uprooting vegetation and, in general, preventing the development of luxuriant beds of submerged aquatics. Even with water levels stabilized, it is doubtful that wild rice could now withstand carp action in the marshes and lakes of this river basin except when water levels are reduced by drought to the extent that carp are denied access to the shallow marshes as in 1961.

In summary, it is well to note that in the "old days" the marshes of the St. Francis River produced some of the best waterfowl hunting in the state; and fur trapping was a major business here. This is no longer true due to drainage, excessive beaver control and an invasion by carp.

Following closely after World War II local conservation groups became interested in the possibilities for restoring the wildlife values of the St. Francis River basin and approached the State Conservation Department for assistance. State biologists inspected the area in 1948, 1950, and again in 1954. State engineers made limited surveys to determine feasibility and to locate potential dam sites.

Although the biological and engineering data did indicate the proposal to be feasible, the State concluded that because of the size of the project, costs involved and strong local interest in Federal participation, the project was best suited for Federal acquisition and development as a nations wildlife refuge. The State, accordingly early in 1961, referred the project to the Bureau of Sport Fisheries and Wildlife for consideration.

IV. PRESENT WILDLIFE VALUES

From a ground breeding pair count made on Rice Lake and along the St. Francis River channel from Santiago to the interception of County Road #4, a straight line distance of 26 miles and an actual flow line distance of 55 miles, it is estimated that there was a Breeding population of 1,000 ducks and 500 coots on the entire refuge area. Of this duck total, 44.6 percent were mallards, 40 percent were woodducks and 15 percent were blue-winged teal.

It is estimated that in 1961 2,000 ducks were produced and combined with the coot production, the total waterfowl production will be approximately 3,000 birds within the 31,750 avres included in the refuge boundary.

There are no quantitative data on the fall migration of waterfowl through the basin. There is one report of 300 woodducks seen in a flock on Rice Lake in 1957; however, it is known that a substantial flight of mallards and coots passes through the area regularly each fall.

There are a few reports of Canada geese being taken in the area in the fall and many reports of large flocks of Canada geese flying southward over the area.

There is a moderate pheasant population present, estimated to average 20 birds per square mile. Bob-white quail have been seen occasionally and fuffed grouse are also present. Mourning doves are abundant nesters throughout the area.

The deer herd using the project is estimated to number approximately 100 animals. Muskrats are not numerous at present. Beaver have been practically eradicated; however, one occurrence of fresh sign was seen along the river above Rice Lake. Mink and raccoons are present in fair numbers. Gray and fox squirrels and cottontail rabbits are common.

Waterfowl hunting followed by squirrel hunting are the chief recreational activities now being carried on. There is some fishing for northern pike being done along the river channel.

V. MANAGEMENT POTENTIAL

Possibilities for development of additional marsh areas of high quality are extremely good. The St. Francis River offers a reliable water supply for impoundments. Ditches can be dammed to reflood drained marshes. There is an excellent interspersed of farm land and grass land throughout.

The area lies in a migration route of a major flight of mallards, blue-winged teal, woodduck, lesser scaup and ring-necked ducks. It also lies on a flight line of Canada geese of unknown, but undoubtedly substantial magnitude. In essence, the project contains all the elements necessary for the development of a high quality waterfowl area.

Water Development

There is a potential for creating 30 impoundments totaling 10,300 surface acres. Pool water surface will vary from 40 - 1480 acres in size and will be bounded by 300 miles of shoreline. Depth of these impoundments will vary from 0 to 11 feet but only 5% of the pool area will be $4\frac{1}{2}$ feet or greater in depth.

In addition to the artificially created impoundments there are approximately 100 semi-permanent and permanent type potholes on the area which provide waterfowl breeding sites. These will not be obliterated by impoundment. There is potential in the northeast corner of the project for creating more pothole type habitat through level ditching, bulldozing, blasting and installing small dams in existing small drainageways. Beaver activity will be expected to increase in this area and will no doubt contribute a beneficial increment of waterfowl habitat.

Marsh Management

Control structures will be designed so that complete manipulation of water levels from empty to full can be accomplished in each of the thirty pools. This will facilitate management for vegetation control, carp control and the fulfillment of ecological objectives.

No aquatic plantings are recommended for any of the pools. There undoubtedly is an adequate supply of residual seeds and tubers to revegetate the marshes once favorable conditions are developed.

Upland Management

The uplands associated with pools in the north and central portion of the project should be cultivated, insofar as soil capability will allow,

to produce supplemental duck and goose food. Pool margins and islands should be managed primarily to provide nesting cover for waterfowl. The sandy, relatively unfertile rolling upland which may be subject to wind erosion should be managed with practices designed to control the erosion threat. These areas are perhaps more suited to benefit upland types of wildlife such as deer, grouse, squirrels and pheasants. Extensive pine plantings have been successful on the light soils in this vicinity and should be considered for a cover type in developing land of this type.

Buildings

This will be a major refuge area in size and importance. Building needs will include one combination office and shop; and one storage building to accommodate vehicles, oil and paint, boats and small equipment, and possibly grain. A visitor center should be considered as a heavy tourist load is anticipated. Residences will be required to house permanent personnel.

Staff

The basic staff of permanent personnel will include a refuge manager, assistant manager, trainee manager, naturalist, clerk, maintenanceman and operator general, or two maintenancemen plus temporary field personnel.

Fencing

It will be necessary to fence and post approximately 50 miles of boundary.

The following information was extracted from a preliminary engineering report for the Sherburne Refuge and prepared by the engineering Department of Region III, Bureau of Sport Fisheries and Wildlife in 1962.

I. Description

The Refuge area lies in the western edge of the Anoka sand plain. The surface is rolling with imperfectly developed drainage. The surface topography was created during the retreat of the Grantsburg sub-lobe of the Wisconsin ice sheet about 25,000 years ago. This

sub-lobe intruding from the south blocked the normal movement of water down the Mississippi valley and diverted it northward for a brief period of time. The water flowing around the front edge of the ice as it retreated deposited the extensive area of fine to medium fine sand that generally blankets the area. The rapidly changing path of the water as the ice melted also created the terrace effect. Vegetation established itself on this sandy surface rather slowly and during this intermediate period there was some movement of the surface sands by wind action. This sand dune effect is particularly noticeable in the Sand Dunes State Forest which borders the refuge area on the south.

The north and west boundaries of the refuge area lie in the transition zone between the river deposited sand mantle and glacial drift. Small areas of glacial drift are morainal surface characteristics are scattered throughout the refuge.

The St. Francis River enters the northwest corner of the area from the north and turns easterly through the broad, flat meadow-marsh that makes up the northern one-third of the refuge. Near the east boundary the river turns south and continues through the refuge in a southerly and then southwesterly direction until it empties into Big Lake. The narrow meandering river channel varies in width from 20 to 50 feet and for the most part is less than four feet deep. The river channel is a continuous procession of oxbows and cutoffs with many partially obliterated segments of old channels. The straight line length of the river within the boundary is 14-miles. The actual length, including all the meanders, is probably three times the straight line distance. The total fall of the river through the refuge is 63-feet or an average of 4-feet per mile. However, this fall is not uniform and the river gradient varies from zero in the vicinity of Rice Lake to as high as 7 to 10-feet per mile downstream from the County Highway #21 bridge.

The river is contained within a definite valley. This valley is wide and flat in the northern part of the refuge and then narrows to a width of several hundred feet before it turns south. For one mile above and seven miles below Rice Lake, the river valley is sharply defined and averages out as 1/4-mile in width. The valley sides in this portion rise steeply to a height of 30 to 50-feet above the valley floor.

Glacial Lake Grantsburg occupied a large area north and northeast of the refuge and bay of this lake once covered an area very close to the north boundary. The much higher agricultural quality of the land is very evident in portions of the old lake bed. Generally the east-west section of the St. Francis River marks the line between the low value, sandy topsoil and the glacial till and lake bed deposited soils. Only a narrow strip of the higher quality farm land lying along the north boundary is included in the refuge.

II. Climate

- a. The ground elevation varies from 933 m.s.l. in the river valley in the southeastern corner of the refuge to 1005 m.s.l. along the north and west boundaries. The highest point, 1090 m.s.l. is on the top of the only large hill (Blue Hill) in the area located one mile northwest of Rice Lake.
- b. Data from weather station at Milaca - 12-miles north of Sherburne refuge: (See Table I)
- c. This area is subject to the usual range of storms common to the upper Mississippi Valley. Thunderstorms, hail and tornadoes prevail in the summer nad ice storms and blizzards in the winter.

III. Land

- a. The topography of the site is ideal for the development and management of water areas for waterfowl and a more than adequate supply of good quality water is available. The comparatively steep gradient of the river is ideal for independent management of impoundments. Before the intrusion of the white man, nearly one half of the refuge area consisted of marsh, wild rice beds, open water and tamarac swamp. Early in the 1900's attempts were begun to drain and farm or pasture some of the wet lands. Most of these attempts at drainage were unsuccessful and much of this partially drained land has reverted to sedge-meadow. The many drainage ditches have only succeeded in lowering the water table and increasing the spring flooding by acceleration the runoff. Blocking the drainage ditches and raising water levels will bring up the water table throughout the refuge area. This will have two very beneficial effects: (1) Permanent potholes will be created in many of the depressions in the uplands: and (2) the amount of ground water storage will be increased causing a corresponding increase in the duration and quantity of discharge from the many springs both within and downstream from the refuge area.

Accurate predictions of the effect the development of impoundments will have on the ground water table are impossible. The ground Water Branch of the U.S.G.S., when contacted, expressed interest in conducting a study to evaluate the cause and effect relationship.

Because of the sandy and very pervious nature of the topsoil, most of the precipitation falling on the area is absorded and later released as ground water seepage. For this reason flows in the St. Francis and Elk Rivers are higher in the late summer and fall months than would normally be expected. Movement of ground water in these fine grained sands is very slow. This is substantiated by the large

TABLE I

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Annual</u>
Avg. Precip.	.9	.9	1.5	2.0	3.7	4.5	3.3	3.7	2.4	2.0	1.5	.8	27.2"
Mean Snowfall	8.4	8.4	8.6	2.2	.1	T	T.	T	.1	.6	6.2	6.5	41.1"
Mean Max. Temp.	22	25	36	54	68	77	84	81	77	60	39	26	54. Degrees
Mean Min. Temp.	2	4	17	32	44	54	60	57	48	37	22	9	32 Degrees
Highest Temp.	60	57	79	92	107	101	108	103	104	88	71	63	108 Degrees
Lowest Temp.	-38	-38	-25	4	20	30	42	34	22	7	-16	-32	-38 Degrees

difference between surface elevations of existing water areas. Seepage losses through refuge dikes will not adversely affect the impoundments.

The increased ground water storage obtained by raising the water table will have an additional beneficial effect during dry summers and falls. Ground water seepage into the refuge impoundments will help offset evapo-transpiration losses.

The refuge does present a number of problems in development and management, all of which can be summounted by proper planning and design. The main problem is control of carp.

There are two sources from which carp can enter the St. Francis River drainage, by swimming upstream from the Elk River and from Elk Lake. A carp barrier will be required at each of the outlet structures of all major pools. The maximum water depth in Rice Lake is less than 4-feet, and with the exception of several 6-foot deep holes in the river channel itself, this is the maximum depth of water found anywhere in the river watershed above the Rice Lake outlet. Through the use of a combination of freeze-out and chemicals, control of fish life should be possible after a carp barrier is erected in the Rice Lake outlet. Carp popolations in the refuge pools below Rice Lake will need to be controlled by water level manipulation. The primary source of carp infestation occures each spring during high water when the fish swim upstream from the Elk River. Once this source is blocked by a barrier at the outlet from Pool 8, minumum control will have been achieved.

The Minnesota Pipeline Company has a cross-country pipeline that angles across the northeast corner of the refuge. This line transports crude oil. Company officials were contacted and they stated there would be no objection to flooding over their line provided the Bureau would agree to draw down the water if repaires were ever needed.

b. No test borings were made in the refuge area. Surface soils are primarily sand and silty sands. Depth of these sandy soils varies greatly and ranges from less than a foot to 30 to 50-feet. The sandy topsoil is underlain by glacial till and morainal deposits. Bed rock consists of sandstones, limestone and shales.

IV. Water

TABLE 2 - Peak Discharge & Frequency Data

Data	Elk River USGS	St. Francis R. at Co. Rd. 15	St. Francis R. at Rice Lk. Outlet	Elk Lake Outlet
Drain Area	615 Sq. Mi.	206 Sq. Mi.	144 Sq. Mi.	38 Sq. Mi.

Mean Annual	2000 cfs	1000 cfs	850 cfs	475 cfs
10 Year	4000 cfs	2000 cfs	1700 cfs	950 cfs
25 Year	5300 cfs	2650 cfs	2250 cfs	1260 cfs

The drainage area of the St. Francis River represents one-third of the total Elk River watershed above the gauging station. However, 50% of the flow at that point was used to estimate the runoff on the St. Francis River basin. The reason for this difference lies in the fact that the runoff per square mile per unit of time varies considerable in the watershed. Stream flow measurements were made in the St. Francis River on September 26 and November 9, 1962. Comparison of these measurements with the flow at the Elk River gauging station showed that the discharge from St. Francis River constituted 42% and 30% of the total on the respective dates. Much of this fluctuation can probably be attributed to variation in ground water seepage and loss of lake storages.

It is difficult to predict exactly what percentage of the peak flows at the gauging station are contributed by the St. Francis River. The figures used are based on the flood-frequency monograph for this vicinity compiled by the State Division of Waters and are probably very conservative when applies to this specific area.

Flooding occurs annually in this area. The meandering character of the river channel, rapid runoff, small bridge and culvert openings and dense vegetation in the river valley all contribute to the flood-ing problem. Roads in the area are topped nearly every year. Refuge development will greatly relieve this problem by providing flood storage and adequately sized outlet structures.

Drainage ditches are maintained by the County on a direct assessment basis at the present time. Refuge development will not affect any drainage outside the boundary and will lower the cost to the County for ditch maintenance. Refuge impoundments have been designed to eliminate any back-water effect outside the boundary. Agricultural drainage is the only upstream development now existing on the St. Francis River.

Flow curves for the Elk River gauge for the spring period of 1952 and 1962 are used because they represent the extreme and mean years. Peak runoff on April 10, 1952 reached 5330 cfs and the minimum flow was 3.6 cfs on July 31, 1934. The average discharge for the 32 years of record is 246 cfs. This is equivalent to an annual discharge of 292 acfe-feet per square mile of drainage area. The highest floods

occur in the early spring and are the result of rapid snow melt and warm rains. Floods of smaller magnitude occur in the late spring and summer. At very infrequent intervals flooding has taken place as late as September.

The proposed impoundments have a total area of 10,400 acres and an estimated capacity of 23,500 acre-feet. The average gross evapo-transpiration loss is 29-inches, and the average annual precipitation is 25.5-inches. This leaves a net annual evapo-transpiration loss of 3.5-inches. Water use would normally be calculated by applying this figure to the total water area; however, under present conditions there are 1200 acres of open water marsh and 8700 acres of semi-marsh covered with water loving plants in varying degrees of submergence. Thus, the construction of the refuge pools will not increase water use except for water needed in filling the pools. For computation purposes, the estimated increase in water use was estimated to be equal to 2500 surface acres. Applying the average evapo-transpiration loss of 3.5-inches this gives an annual use of 730 acre-feet. In a maximum loss year the evapo-transpiration loss would increase to 18-inches. This is equal to a water use of 3760 acre-feet.

Estimation that one-third of the flow at the Elk River gauge derives from the St. Francis River, the mean annual discharge is 80cfs. This greatly exceeds to quantity of water needed for refuge management purposes. Sufficient water to meet all management requirements will be available 27 out of 28 years. However, low flows in the late summer and fall will result in the lowering of some pools unless water is stored during the higher runoff in the spring, for later release.

The development of the refuge impoundments will require the construction of 8 major and 30 minor water control structures. The major structures will be required at pools 1 through 8 where it is necessary to pass the full flow of the St. Francis River. The major structures will consist of a sufficient number of stoplog bays to pass the mean annual peak flow plus a fixed crest spillway designed to pass the 25-year flood. A 3-foot slide gate at the flowline of the river will be required in each of these structures to obtain complete drawdown of the pools. The minor structures will all consist of one and two bay concrete stoplog type.

SHERBURNE NATIONAL WILDLIFE REFUGE

Princeton, Minnesota

NARRATIVE REPORT

Calendar Year 1965

I. GENERAL

A. Weather Conditions

TABLE I

	<u>Precipitation</u>			<u>Max.</u>	<u>Min.</u>
	<u>Month*</u>	<u>Normal**</u>	<u>Snowfall*</u>	<u>Temp.*</u>	<u>Temp.*</u>
January	<u>.47</u>	<u>.90</u>	<u>11.00</u>	<u>38</u>	<u>-34</u>
February	<u>1.62</u>	<u>.90</u>	<u>12.00</u>	<u>44</u>	<u>-30</u>
March	<u>4.36</u>	<u>1.50</u>	<u>37.11</u>	<u>38</u>	<u>-23</u>
April	<u>3.23</u>	<u>2.00</u>	<u> </u>	<u>60</u>	<u>22</u>
May	<u>7.70</u>	<u>3.70</u>	<u> </u>	<u>81</u>	<u>34</u>
June	<u>3.54</u>	<u>4.50</u>	<u> </u>	<u>90</u>	<u>45</u>
July	<u>4.68</u>	<u>3.30</u>	<u> </u>	<u>93</u>	<u>48</u>
August	<u>5.60</u>	<u>3.70</u>	<u> </u>	<u>96</u>	<u>37</u>
September	<u>5.74</u>	<u>2.40</u>	<u> </u>	<u>80</u>	<u>25</u>
October	<u>1.41</u>	<u>2.00</u>	<u> </u>	<u>79</u>	<u>22</u>
November	<u>2.32</u>	<u>1.50</u>	<u>5.00</u>	<u>69</u>	<u>2</u>
December	<u>1.91</u>	<u>.80</u>	<u>2.00</u>	<u>42</u>	<u>-8</u>
Annual Totals	<u>42.58</u>	<u>27.20</u>	<u>67.11</u>	Extremes <u>96</u>	<u>-34</u>

* Data from the official weather station maintained by Gordon Wold of rural Santiago, $\frac{1}{2}$ mile north of the Refuge.

** Data from the Weather Station from Milaca, Minnesota 15 miles north of the Refuge.

The year 1965 was notable for the excessive precipitation received and the short growing season. Abundant snowfall in January and February was topped by a 30 inch "St. Patrick's" day blizzard on March 17th. Conditions remained cool until a rapid thaw in early April resulted in heavy flooding.

For the balance of the year, precipitation was substantially in excess of normal for all months except June and October. Coupled with cool temperatures, this resulted in late planting of crops and a slow rate of growth. Killing frosts in mid September shortened the growing season and resulted in poor corn and soy bean crops.

B. Habitat Conditions.

1. Water. All lakes, sloughs, potholes and marshes were brim full this year due to heavy runoff and abundant rainfall. Mud Lake, the Bergerson Sloughs, Rice Lake and partially drained Lake Josephine are the only really permanent water on the refuge aside from the St. Francis River.

2. Food and Cover. Much waste corn and soy beans were available for wildlife due to poor harvest conditions. Fall rye in an important crop locally and fits in well with goose use of the area.

High water conditions prevented farming of some areas and many lowland meadows were not cut for hay.

In summary, water, food and cover were abundant and could have supported many more birds than were present.

II. WILDLIFE

A. Migratory Birds.

The Sherburne Refuge lies on major flight lanes for ducks, several species of Canada geese, (including a flock of Giant Canadas which winter at Rochester, Minnesota) and also Snow and Blue geese. Substantial numbers of Whistling Swan migrate through the area also. Up to this point it has been a matter of inadequate water, food and protection which has prevented major concentrations. Heavy local hunting pressure soon discourages waterfowl and they depart for southern climes. By resolving these factors thru acquisition, development and management, the Bureau can make and can be an important waterfowl management unit for this area.

Mallards, Wood ducks and Blue-winged teal comprise the bulk of the local duck nesting population. During migration these species are supplemented with Ringnecked ducks and lesser numbers of all species common to the Mississippi Flyway.

B. Upland Game Birds. The March 17th blizzard all but wiped-out the Ring-necked pheasant population. Since there is first-class pheasant habitat in the area, many sportsmans clubs are undertaking pheasant stocking programs. There is no apparent reason why pheasants shouldn't thrive in this region.

Ruffed grouse are at the low of their cycle but show signs of coming back. Drumming counts are much higher within the refuge than anywhere in the general vicinity.

Sharptailed and Pinnated Grouse have not been observed on the project area in recent years. There are, however, remnant dancing and booming grounds in this portion of the state. Careful consideration in being given to re-establish these birds on the refuge and manage habitat expressly for them.

C. Big Game Animals. White-tailed Deer are common on the refuge. State regulation limit hunters to the use of shotgun slugs for this area, so many hunters pass up good opportunities locally to hunt with a rifle farther north.

Management plans will be designed to harvest approximately the animal increment.

D. Fur Animals, Predators, Rodents, and other Mammals. Since no systematic study has been made, about all that can be done is to report those species known to be present:

- Beaver
- Muskrat
- Mink
- Weasel
- Raccoon
- Striped Skunk
- Red Fox
- Fox Squirrel
- Gray Squirrel
- Red Squirrel
- Cotton-tail Rabbit

E. Hawks, Eagles, Owls, Crows, Ravens, and Magpies. Red-tailed, Broad-winged, Sparrow and Marsh hawks have been observed. Great Horned owls are permanent residents and Short-eared owls are migrants. Crows are numerous and magpies occasionally seen in the winter.

F. Other Birds A start has been made in compiling a refuge bird list. The cooperation of competent members of the Minnesota Ornith-

ologists Union has been secured to facilitate the task. Much interest in refuge bird life is anticipated from the Metropolitan area.

G. Fish. Northern pike, suckers and red-horse make spawning runs up the St. Francis annually. Carp are a problem which will involve considerable effort and expense to solve.

H. Reptiles. Nothing to report.

I. Diseases. Nothing to report.

III REFUGE DEVELOPMENT AND MAINTENANCE

A. Physical Development. There has been no activity in this category since the refuge was staffed on October 12, 1965.

B. Planting. Nothing to report.

C. Collections and Receipts. Nothing to report.

D. Control of Vegetation. None. It is reported that leafy spurge and canada thistle are a problem.

E. Planned Burning. None.

IV. RESOURCE MANAGEMENT

A. Grazing. None to date. No large demand is anticipated since most cattle hers in the vicinity are for dairy purposes. Use by dairy herd would have to be close to the milking place in order to be practical.

B. Haying. None to date. Haying will be discouraged except where it is a necessary part of the crop rotation.

C. Fur Harvest. Not under Refuge control at present. Trappers harvested some mink, beaver, raccoon, muskrat and weasel on the refuge in 1965.

D. Timber Removal. Not under Refuge control at present. Domestic firewood is commonly cut and in a few places, birch is being cut for fireplace wood.

E. Commercial Fishing. Nothing to report.

F. Other Uses. Nothing to report.

V. FIELD INVESTIGATIONS OF APPLIED RESEARCH.

A. Progress Report. Nothing to report.

VI. PUBLIC RELATIONS

A. Recreational Uses. The Sherburne Refuge is within 45 miles of the Twin Cities metropolitan area. It is also located adjacent to the Sand Dunes State Forest which already receives considerable public use. There are at least five lakes in the immediate refuge vicinity which have both summer cottages and year around homes. Thus, considerable public recreational use is anticipated.

In 1965, since the project was just getting underway and no developments were completed, usage of the area was merely incidental. Probably the heaviest use at present is for hunting and fishing. It is estimated that there were 3500 use days in this category in 1965.

B. Refuge Visitors.

Date	Name	Organization
11/10/65	Lester Dundas	Staff Specialist - Acquisition, R. O., Minneapolis, Minnesota
11/30/65	Edward Crozier	Staff Specialist - Planning R. O., Minneapolis, Minnesota
12/10/65	Ron Erickson	Area Game Manager, M.C.D. Forest Lake, Minnesota
12/10/65	John Kirkvold	Area Forester, M.C.D. Cambridge, Minnesota

Mr. Gordon B. Jensen, Appraiser and Jim Goettel's Boundary Survey crew are frequent visitors.

C. Refuge Participation.

Date	Organization	Town	Program	Attendance
9/21	Tri. Co. Cons. Club	Princeton	Discussed Refuge	30
10/14	Tri. Co. Cons. Club	Princeton	Discussed Refuge	30
10/22	Minn. Teachers Conv.	St. Cloud	Passed out Lit.	2000
10/23	H.S. Biology Class	Anoka	Refuge Tour	35
10/25	Chamber of Commerce	Princeton	Refuge Talk	70
10/26	Watershed Planning Board	Elk River	Refuge Activities	12
10/27	Comm. Wildlife Club	St. Cloud	Refuge Activities	100
11/1	Tri. Co. Cons. Club	Princeton	Refuge Talk	30
11/10	Lions Club	Mpls.	Refuge Talk	80
11/23	Tri. Co. Cons. Club	Princeton	Refuge Talk	25
12/15	Comm. Wildlife Club	St. Cloud	Refuge Talk	65

In addition there were many discussions, which were with individuals and small groups, about the refuge program and objectives. Having a cup of coffee with a County Commissioner, influential sportsman, legislator, irate landowner or just interested citizens, can often prove to be beneficial in the long run.

D. Hunting. The Minnesota Conservation Department maintains Public Access areas on Rice Lake, Mud Lake and Lake Josephine for the benefit of duck hunters. The M. C. D. also has Wildlife Management Areas in the project which are purchased with sportsmans funds and are open to hunting. Much of the private land is leased for hunting purposes also.

Some good habitat presently exists there and many ducks come through the area. The only thing wrong is the over-abundance of hunters who spoil the situation for each other and burn the ducks out of the country.

E. Violations. No apprehensions to report although there almost certainly were violations taking place. Coordination has been arranged with Game Warden Dick Simmons at Princeton and Wayne Forsythe at Big Lake, who regularly patrol the area. The Manager accompanied Warden Simmons on deer-shining patrol.

F. Safety. Since only the Manager was present during a portion of the reporting period, no formal Safety meetings have been held. Activity has been limited to reviewing Safety Bulletins and literature.

There were no lost-time accidents from the date of activation of this station (Oct. 12, 1965) until the end of the period. This involves 80 calendar days.

VII. OTHER ITEMS

A. Items of Interest

1. Personnel. On Oct 12, 1965, John C. Carlsen transferred from the position of Supervisor, Area Acquisition Office, Minot, North Dakota to that of Manager, Sherburne National Wildlife Refuge, Princeton, Minnesota. The refuge office was maintained in the manager's residence until Nov. 15, 1965, when space was rented at 113 Fifth Avenue South in downtown Princeton.


Regional Office personnel who are actively engaged in the field work for the project include Appraiser Gordon B. "Bill" Jensen and the Boundary Survey Crew headed by James Goettle.

As of Dec. 31, 1965, purchase agreements had been obtained on 65 tracts totalling 7,272 acres. Although considerable public opposition to the Refuge was generated locally, time, courtesy, proper treatment and a realization of the inevitability of the situation appears to be working in the Bureau's favor. It is anticipated that acquisition will be completed within three years.

B. Photographs. A series of 8" x 10" photographs taken on April 16, 1965 by Pilot-Biologist John Winship and Division of Refuges Staff Specialist Lester H. Dundas are appended. These excellent photos not only serve as a historical record of the peak flood conditions but also convey the general idea of how the refuge impoundments will look when completed.

SIGNATURE PAGE

Submitted by:



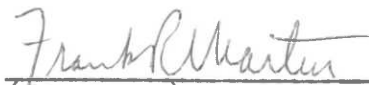
(Signature)
John C. Carlsen

Refuge Manager
Title

Date: _____

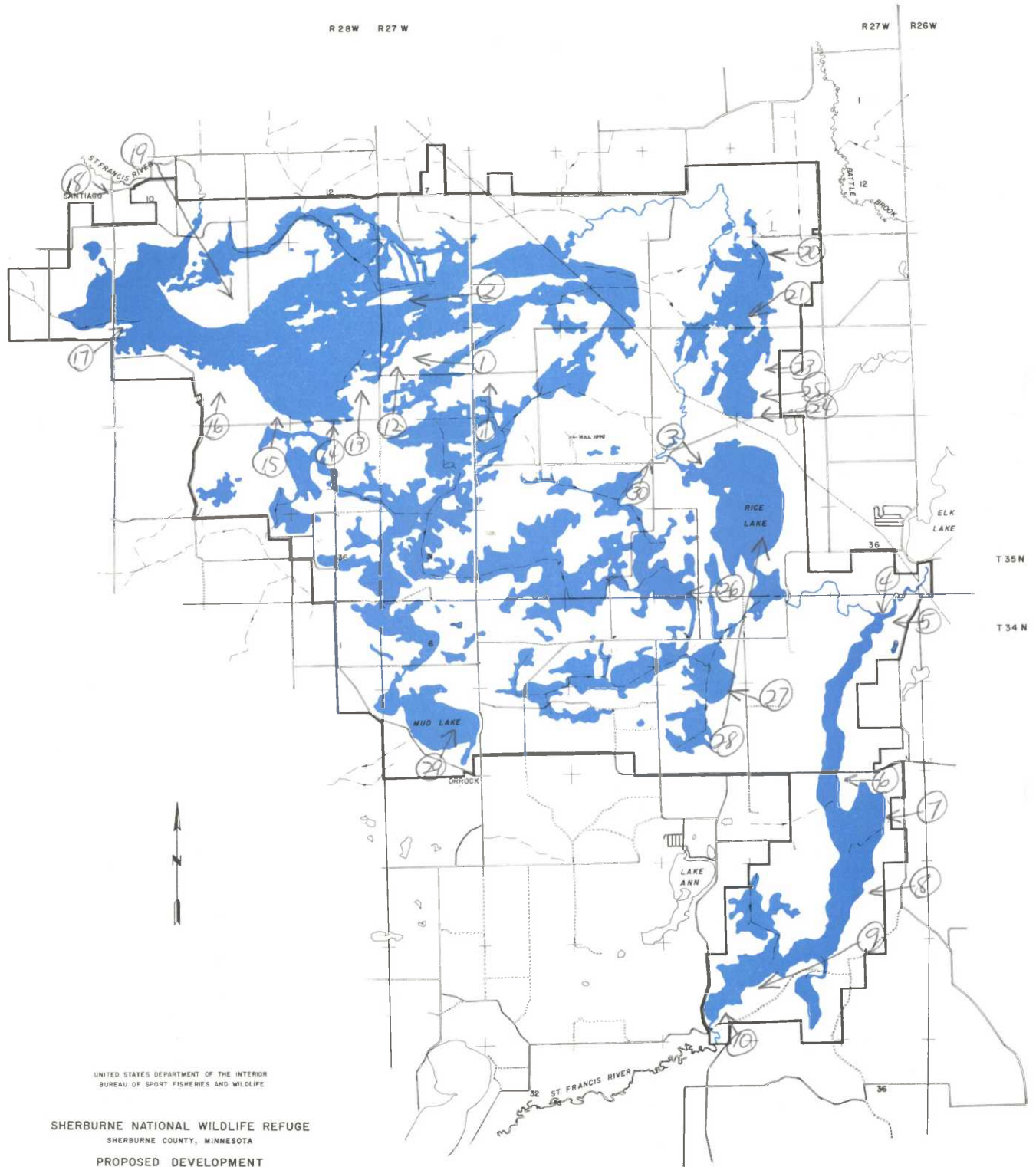
Approved, Regional Office:

Date: April 22, 1966



(Signature)

Asst. Regional Refuge Supervisor



Water conditions were below flood crest (3 days) in upper 1/3 of river in project when pictures were taken. (bad weather). Engineer set stakes on levels on 4/16/65.

♂ Picture points and direction
Winship & Dundas 4-16-65

Photo Point #1 - Westerly view across croplands and valley of the St. Francis river thru the center of the refuge. Taken on April 16, 1965 under flood conditions by Pilot Biologist Winship and Refuge Staff Specialist Lester Dundas.



Co. Road 5

Photo Point #2 - St. Francis river valley in flood on April 16, 1965.
This approximates pool levels when refuge impoundments are completed.
4/16/65



Photo Point #3 - Looking southeast across Rice Lake. St. Francis
river flows out of south end of lake and joins outlet of Elk Lake.
4/16/65

Elk Lake



Photo Point #4 - Junction of St. Francis river and Elk Lake outlet.
The impoundment here will create lake-like conditions and primary
use of the area will be for nature-oriented recreation. 4/16/65



Photo Point #6 - Looking west along the Zimmerman-Orrock black
top Road where it crosses the St. Francis river. 4/16/65



Photo Point #7 - View west across flooded valley of St. Francis
river. Note numerous pine plantations. 4.16/65



Photo Point #8 - View west across flooded valley of St. Francis
river. This impoundment will be used for recreational purposes.
4/16/65



Photo Point #9 - Southwesterly view along flooded valley of St. Francis river. In upper right background is Lake Ann and in upper left, Eagle Lake. The area in between is a portion of the Sand Dunes State Forest. 4/16/65



Photo Point #10 - Twin bridges in center foreground constitutes
the extreme southern tip of the refuge. A large combination dam
and roadway here will create a lake for nature oriented recreation.
4/16/65



Photo Point #11 - County Road #5 thru center of refuge will be rebuilt into a combination dike-roak by a joint County Refuge project. 4/16/65



Photo Point #12 - View north across flooded valley of St. Francis
river thru center of refuge. This view is at right angles to
photos 1 and 2. 4/16/65



Photo Point # 16 - Western portion of Sherburne refuge. The Fox farm in the center is an island at these water levels which approximate refuge pools. Jog in boundary in lower left hand corner is Santiago cemetery. 4/16/65



Photo Point #17 - Western portion of Sherburne refuge. Black top
is known as Salida road and runs north to Santiago. 4/16/65



Photo Point #18 - Town of Santiago at northwest corner of Sherburne Refuge. St. Francis river flows past town. 4/16/65



Photo Point #19 - Looking southeast from Santiago across Fox farm
on "island" to large flooded area which approximates refuge pool.
4/16/65



Photo Point #20 - Northeastern corner of Sherburne Refuge. Farms
of brothers Ed and George Brown in center of picture. 4/16/65

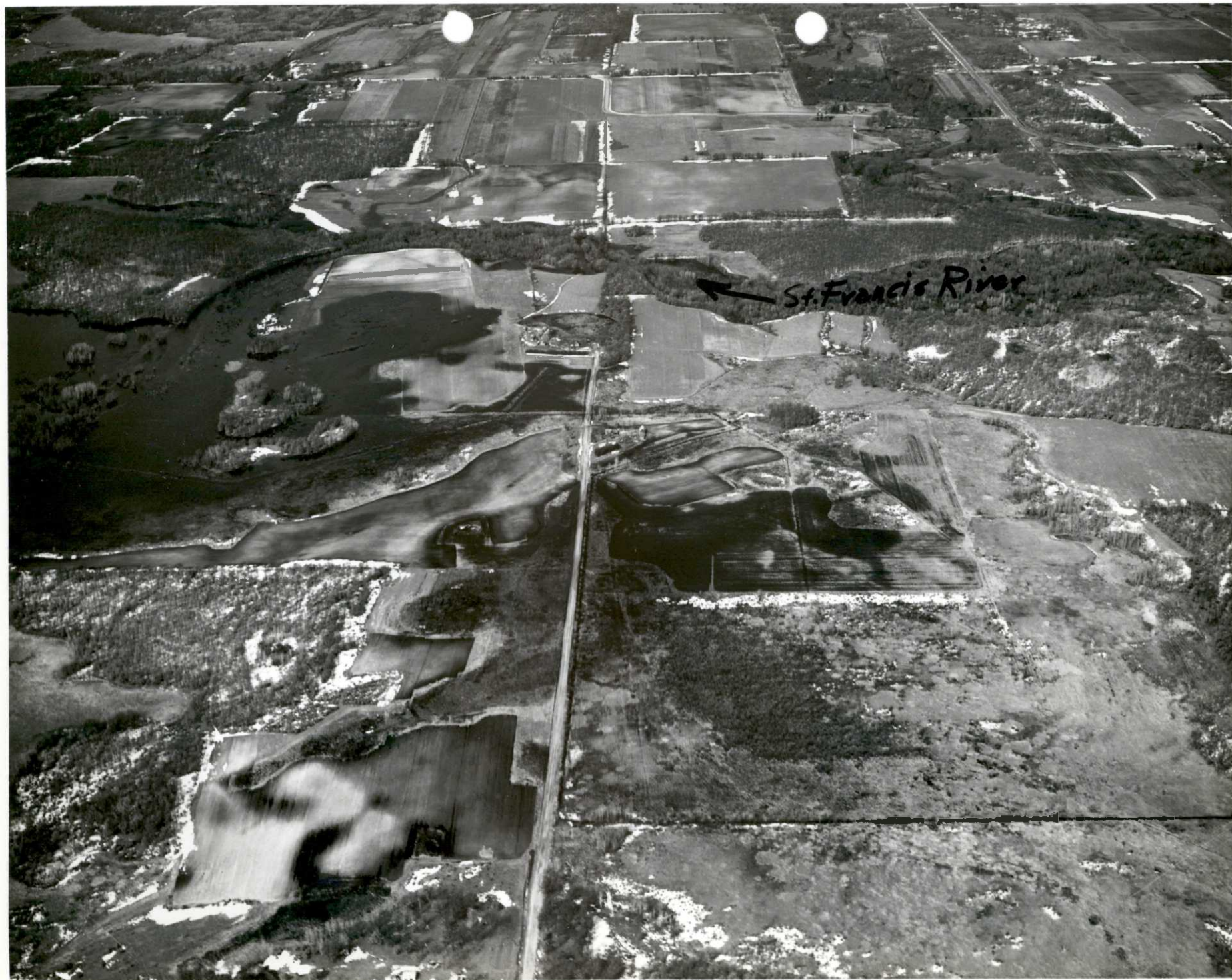


Photo Point #24 - East central portion of Sherburne Refuge looking
westerly. Blue Hill in the background has been proposed for the
refuge headquarters site. 4/16/65



Photo Point #26 - Bergerson slough area southwest of Rice Lake.
4/16/65

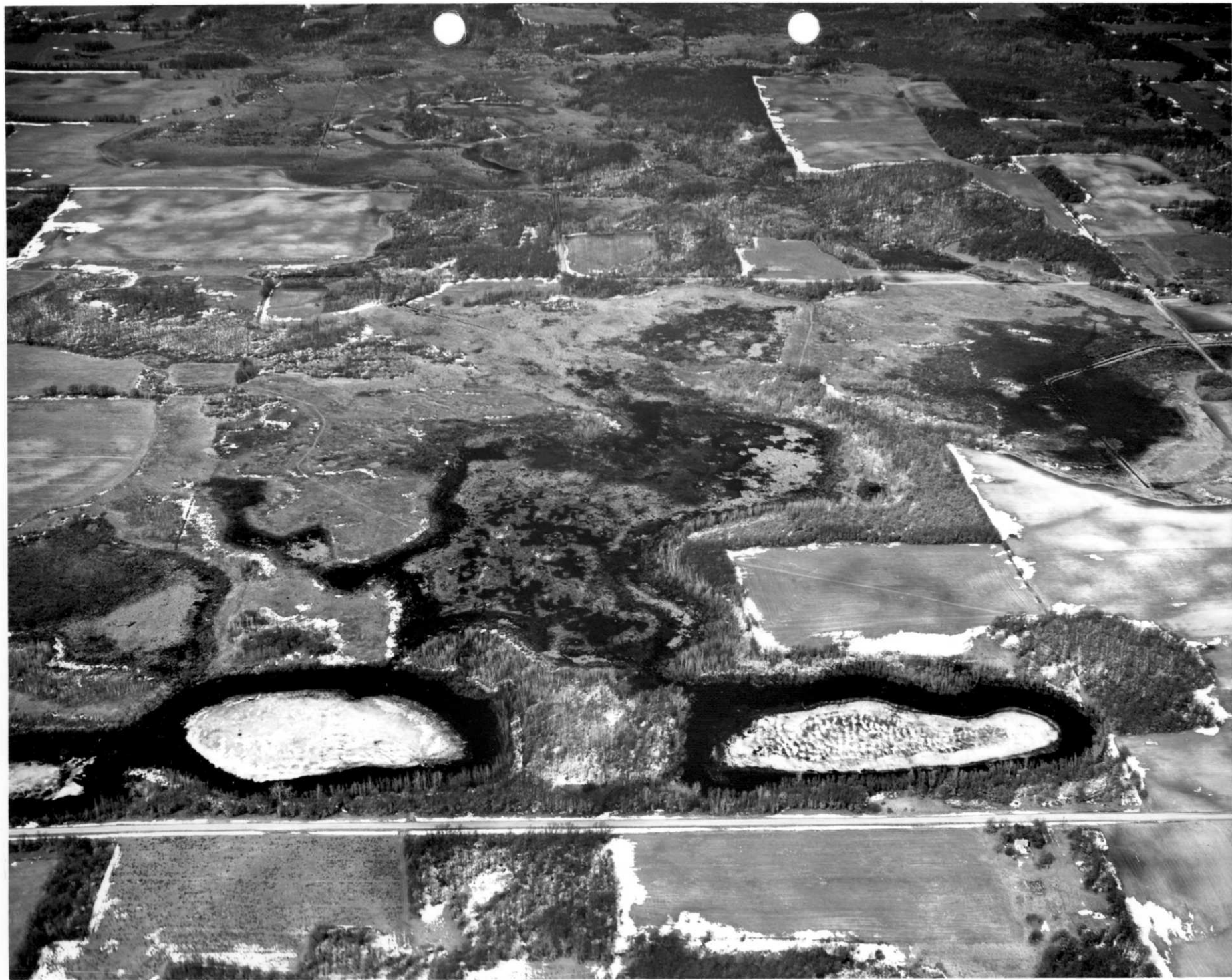


Photo Point #27 - Partially drained Lake Josephine in southeast portion of refuge. Simply plugging the outlet ditch will greatly improve the waterfowl habitat here. 4/16/65



Photo Point #28 - Long range view toward northeast across Lake
Josephine in foreground and Rice Lake in center. Town of Princeton
is in upper right hand corner. 4/16/65



Photo Point # 29 - This is Mud Lake at the southwest corner of the Sherburne Refuge. It is still covered with ice on April 16, 1965. In 1965 this lake had a luxuriant stand of wild rice and provided excellent waterfowl habitat. It receives heavy hunting pressure.

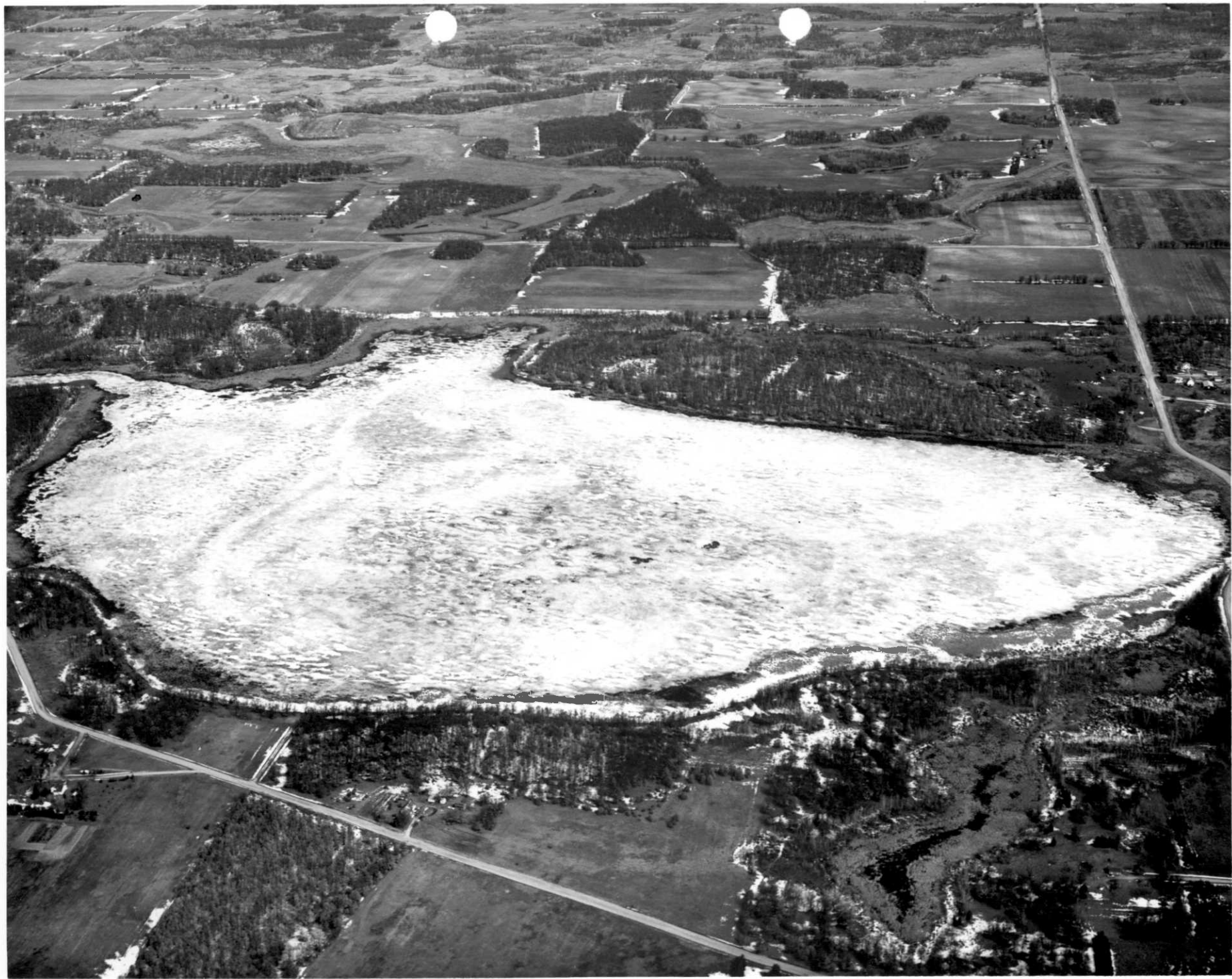


Photo Point #30 - The road intersection is the junction of County Roads 9 and 21 near the center of the Sherburne refuge. The St. Francis river was in flood when the photo was taken on 4/16/65. The Galbraith Cemetery is one of three cemeteries which the Bureau is obligated to maintain access to.

